A future lidar mission for cloud and aerosol measurements

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Clouds evolution and feedback to anthropogenic forcing and atmospheric circulation change remains one of the major uncertainty sources in climate sensitivity estimation. Lidar observations on satellites present a good tool for accurate 3D atmospheric measurements by day and night. Long-term series are needed for cloud trend detection and response to anthropogenic forcing [1].

As a continuity to CALIPSO (since 2006, [3]) and EARTHCARE (planned for 2022, [4]), NASA and CNES are studying a future satellite mission [2]. However, the combination of the three missions is complicated because of the satellites and instruments differences.

While CALIOP on-board CALIPSO emits at 532 nm, ATLID on-board EARTHCARE emits at 355 nm. The atmospheric molecular scattering at 355 nm is 5 times greater than the 355 nm scattering making particulate detection more difficult in the UV. Another difference between the missions is of a geometrical order: the altitude of CALIPSO and the field of view of its telescope are respectively of 705 km and 130 µrad while for EARTCAHRE they are of 408 km and 65 µrad. This makes the geometry of CALIPSO less favorable than EARTHCARE for a good signal-to-noise ratio.

In this study, we evaluate the signal quality and the particulate (clouds and aerosols) retrieval capacity for the three lidar missions and we show that this new lidar mission could reconcile CALIPSO and EARTHCARE differences.

References

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